



Nitrate and Dissolved Organic Carbon Concentrations in Riparian-Zone Ground Water of the Lower San Joaquin River, California

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Outline

- Water Quality Issues and Reason for Study
- Study Area and Study Design
- Monitoring Wells (1988, 9/06 – present)
- Boat Reconnaissance (8/07)
- Synoptic sampling (8/07)
- Conclusions

Water Quality Issues and Reason for Study

Water Quality Issues

- **Nitrate** – contributes to algal growth in SJR which (1) contributes to low dissolved oxygen in Stockton Deep Water Ship Channel that can be barrier to Chinook salmon migration, and (2) affects cost and effectiveness of water treatment
- **Organic Carbon** – potential for formation of disinfection byproducts when water is treated

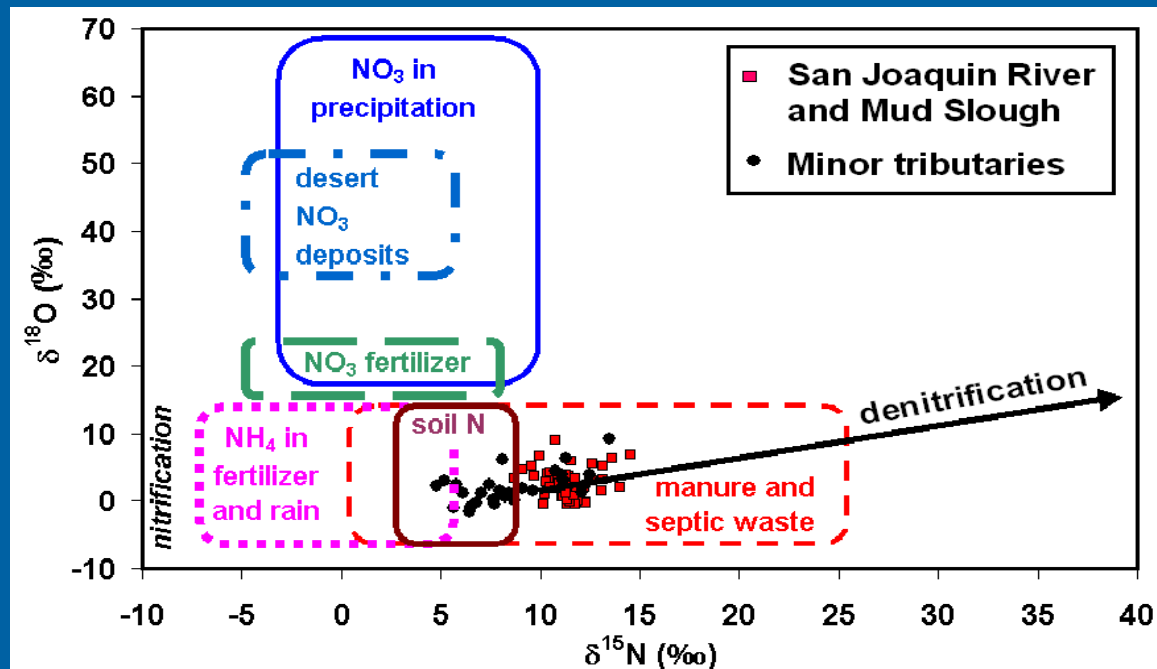
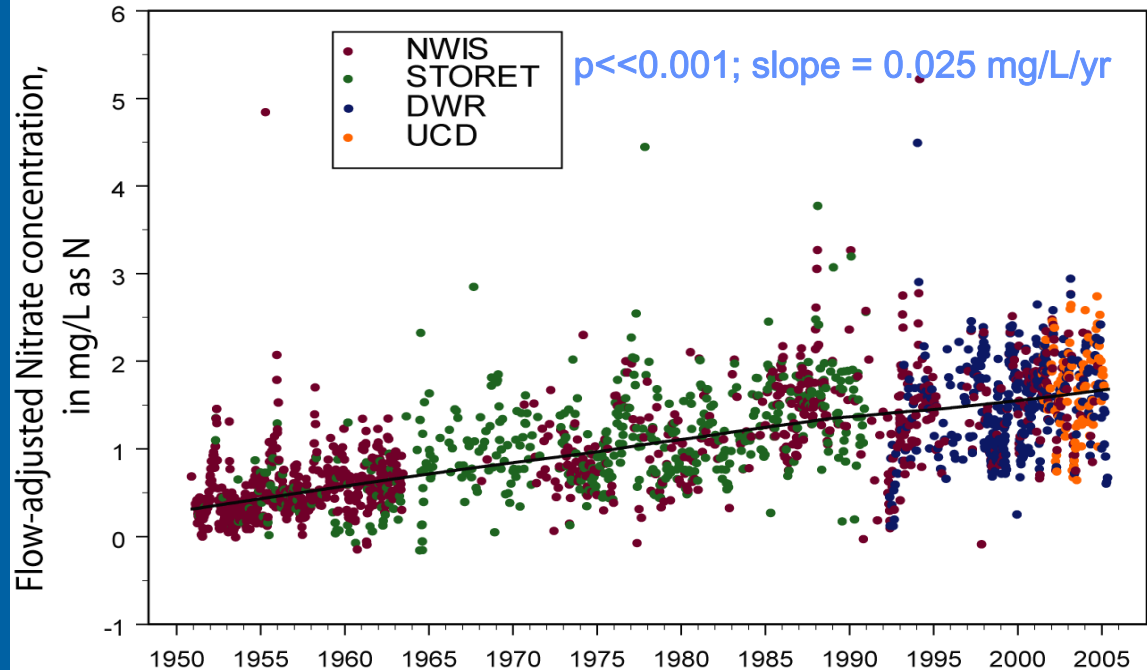
Reason for Study

Increasing nitrate trend in SJR along with nitrate increases in fertilizer, manure, tile drainage and in soils and regional GW of SJB.

Recent study (2001) showed SJR isotope fingerprint (animal waste) to be different from tributaries (soil N).

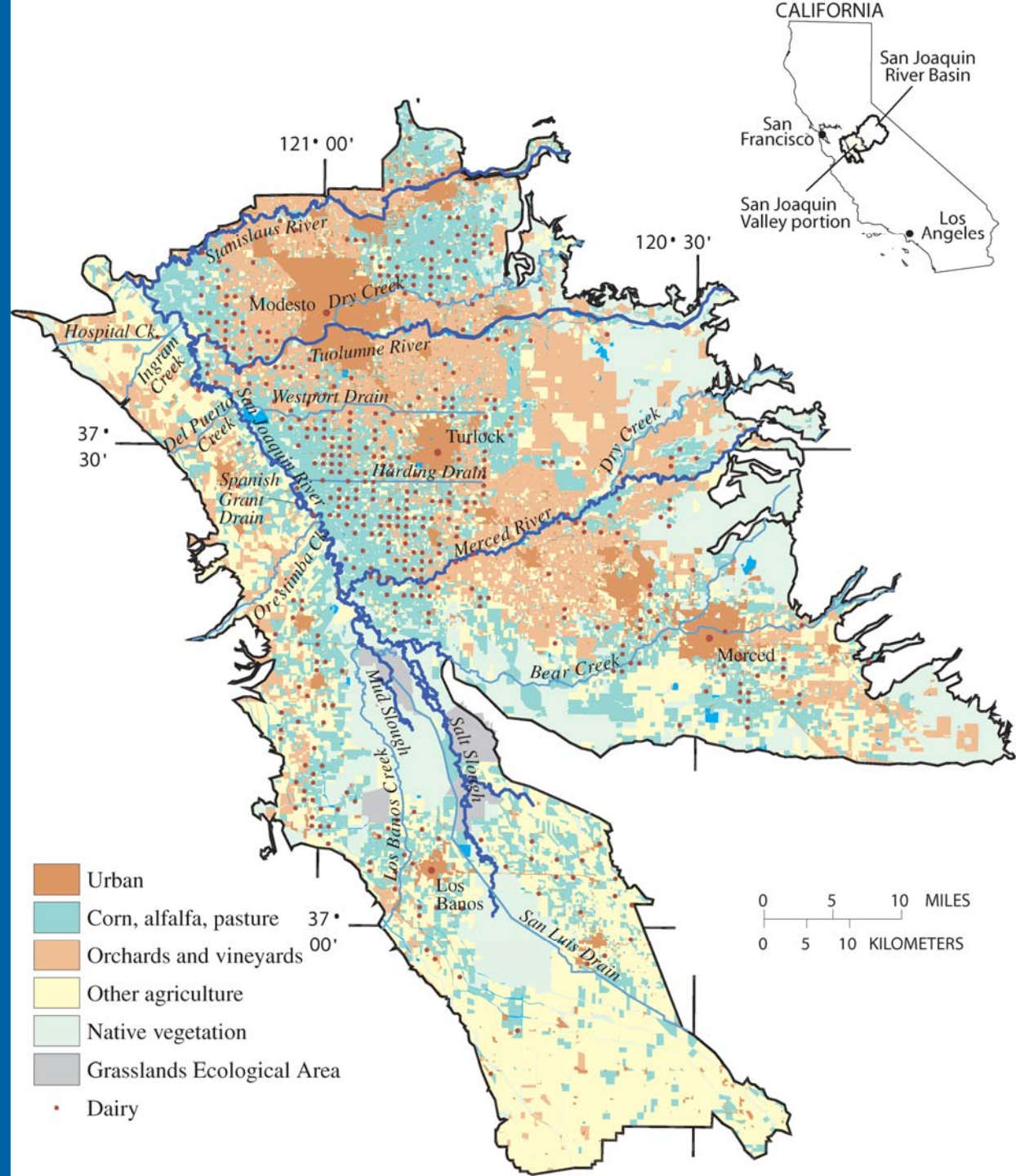
Hypothesis to be tested with this study:

GW nitrate from animal waste is a significant source of nitrate in SJR



Study Area and Study Design

Study Area:
60 river miles
from above
confluence of
Salt Slough
to Vernalis



3 Approaches to defining GW nitrate (and organic carbon) inputs and sources

(1) Nested monitoring wells

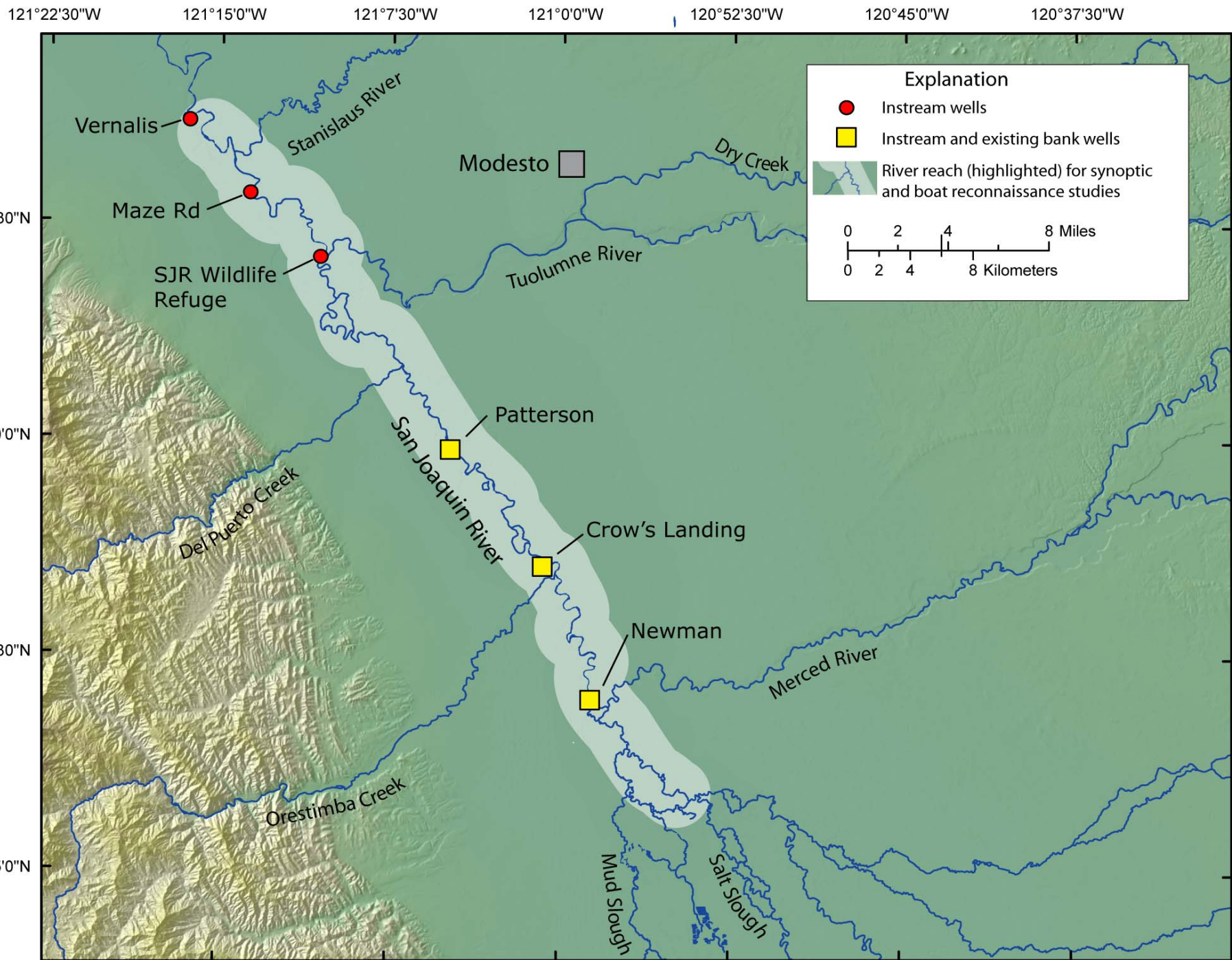
- On banks (10'-100') and in-stream (5'-30')
- Continuous temperature and hydraulic gradients
- Modeling (2-D MODFLOW at 3 sites; 1-D heat transport at 6 sites)

(2) Boat reconnaissance

- Look for GW “hot spots” with continuous water quality measurements just above streambed

(3) Synoptic sampling

- 30 transects between 6 fixed sites
- Temperature and hydraulic gradients, and water quality below streambed



Data being collected

Monitoring Wells

- EC, pH, DO, temp
- NO₃+NO₂, NH₄, PO₄
- DOC/DIC incl. optical scan
- Trace elements
- Isotopes (N, O, S, C) *
- N₂ and Ar gas *
- Hydraulic Gradient

Synoptic

- EC, pH, DO, temp
- NO₃+NO₂, NH₄, PO₄
- DOC/DIC incl. optical scan
- Trace elements
- Isotopes (N, O, S, C)
- N₂ and Ar gas
- Hydraulic Gradient

Boat Reconnaissance

- CDOM, chl-a – fluorometer
- EC, temp, pH, DO – multiparameter probe
- gps

* Quarterly sampling only

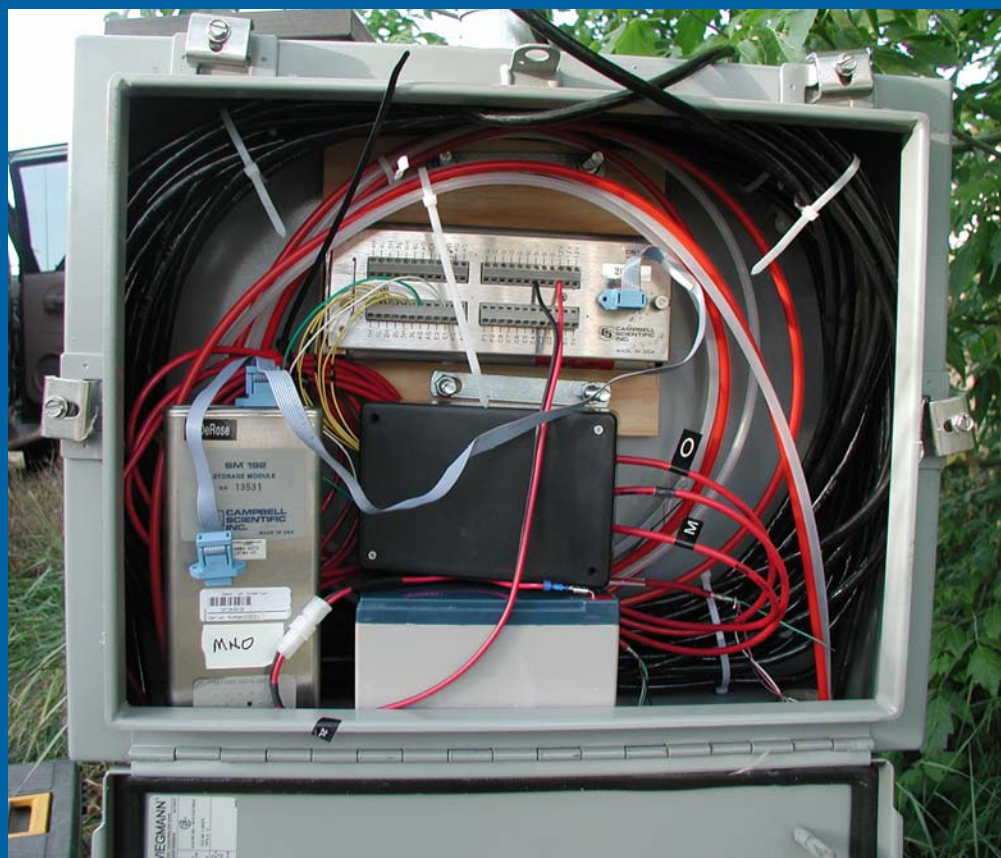
Monitoring Wells (1988, 9/06 – present)



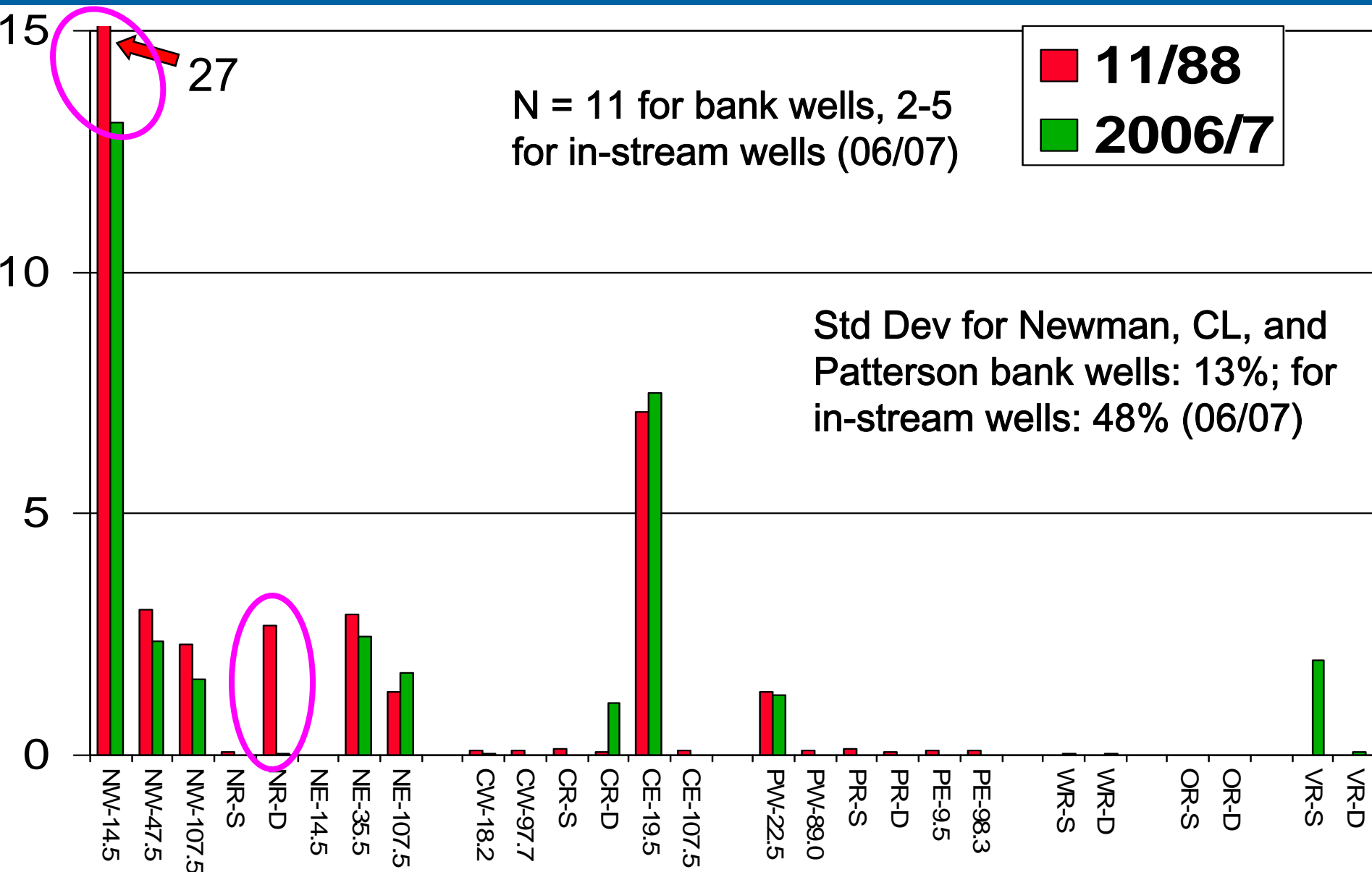
Sampling Bank Wells

In-river paired monitoring wells (5-10 ft; 20-30 ft)

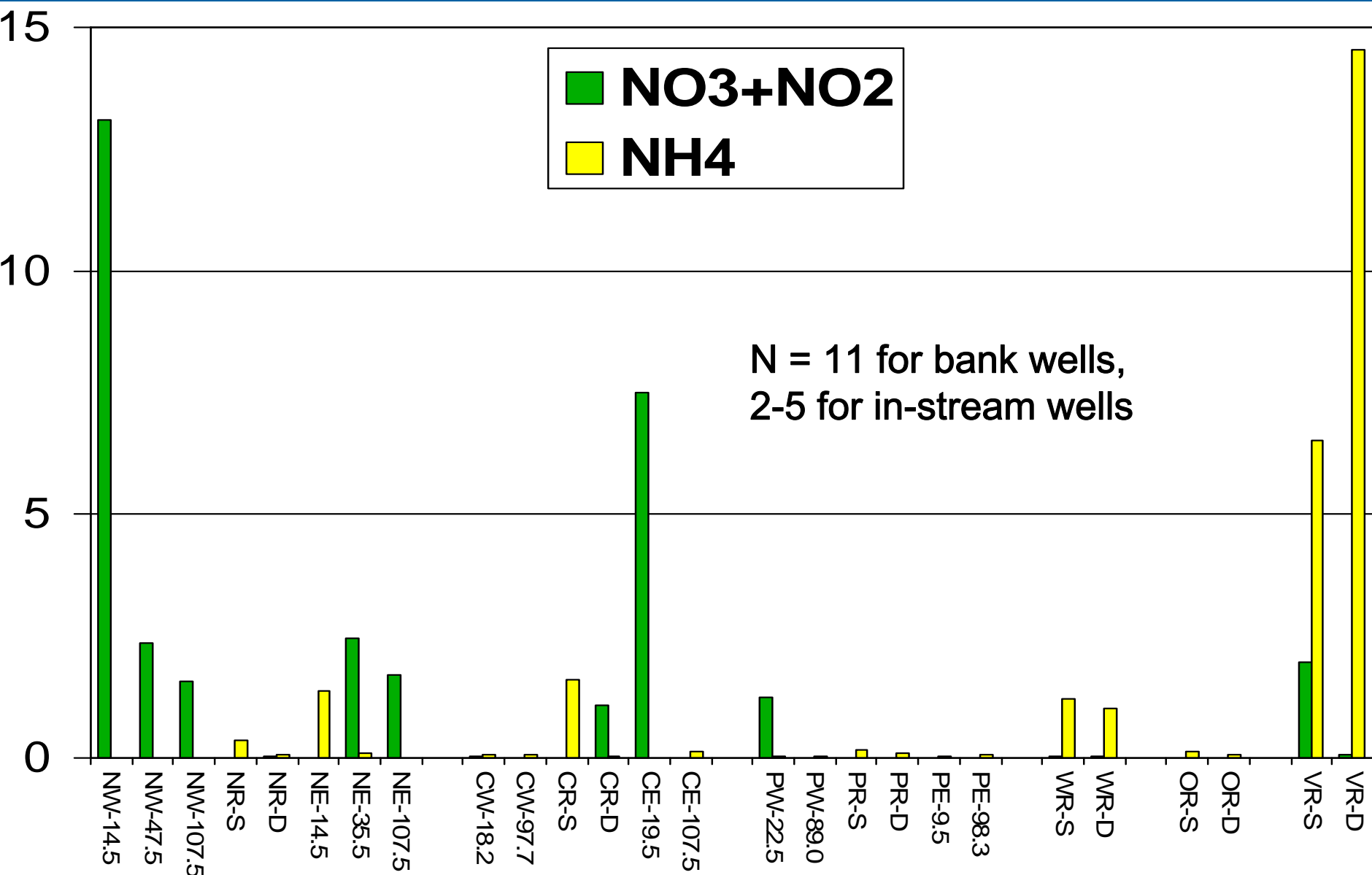
Vernalis



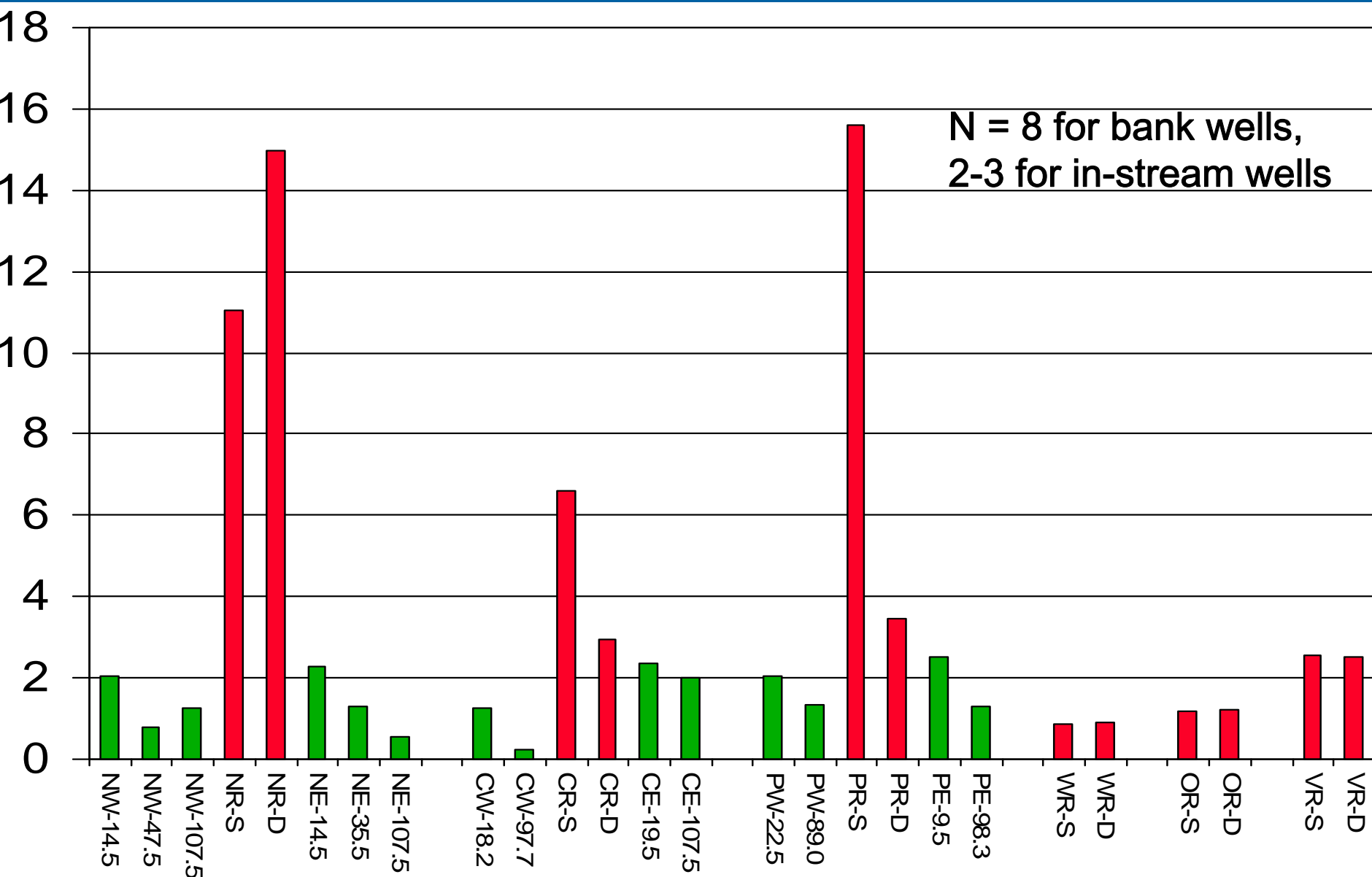
NO₃+NO₂ in Monitoring Wells, in mg/L as N



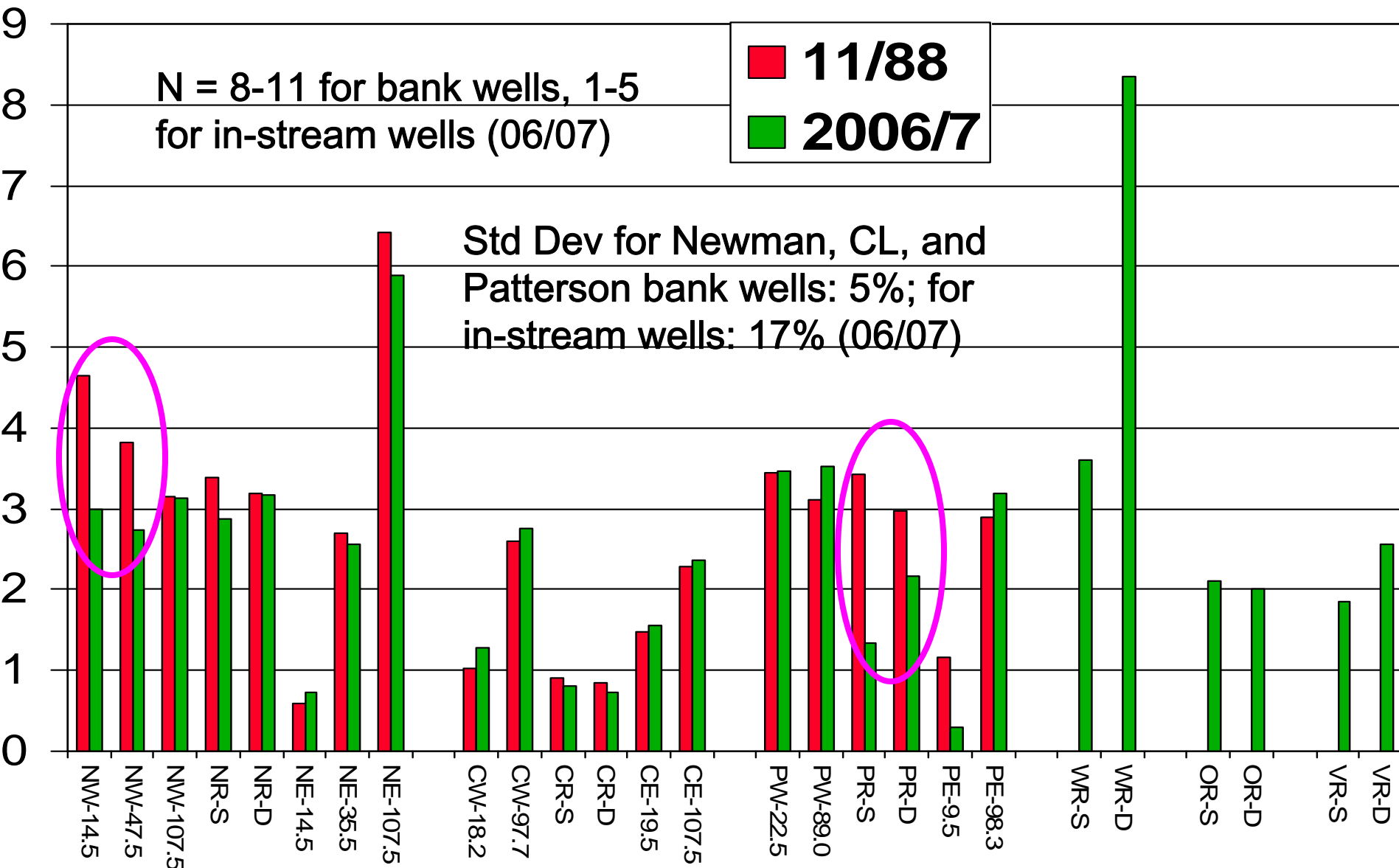
NO₃+NO₂ and NH₄ in Monitoring Wells, in mg/L as N



DOC in Monitoring Wells, in mg/L as C



Electrical Conductivity in Monitoring Wells, in dS/m



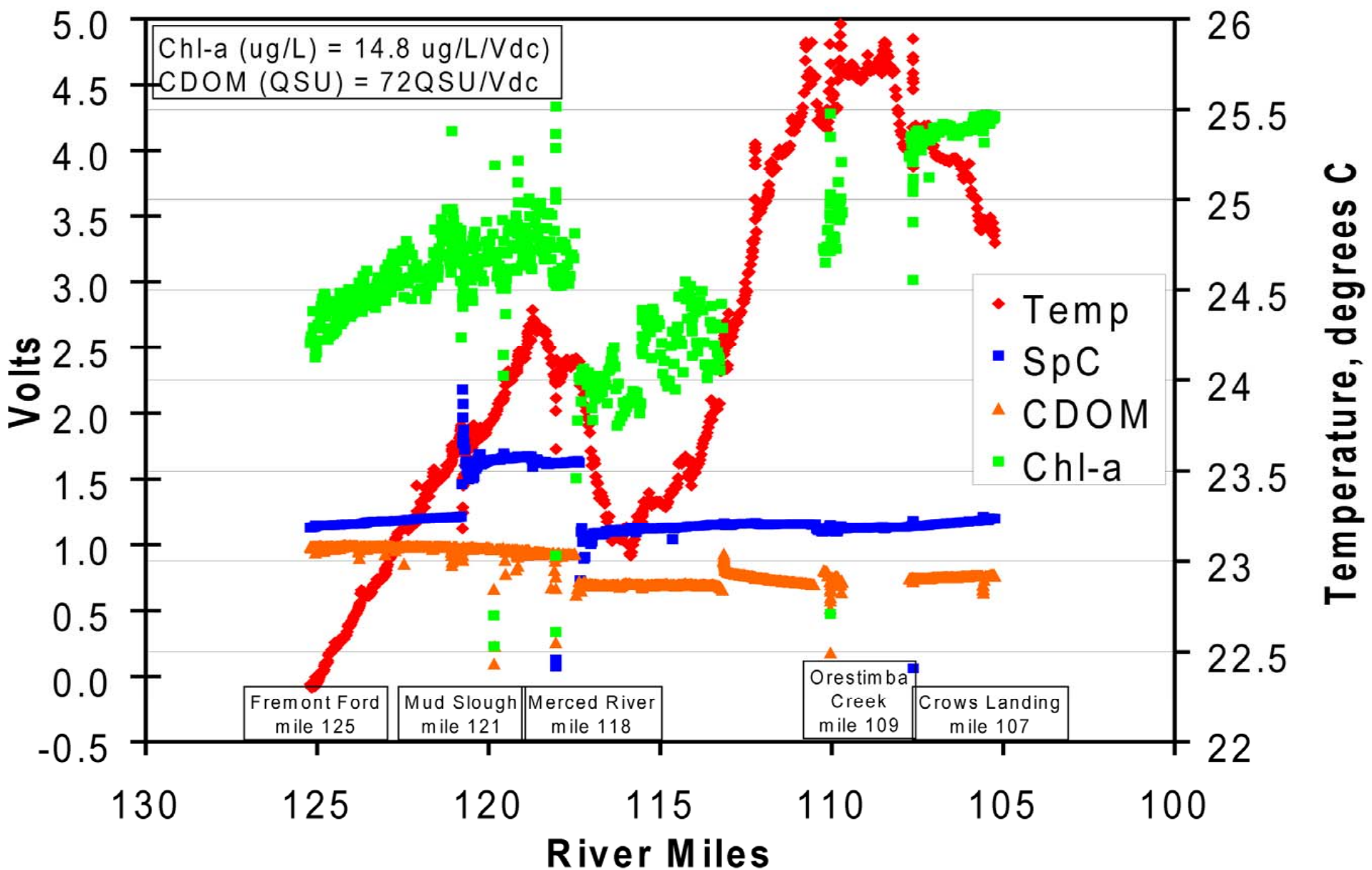
Boat Reconnaissance (8/07)



River water is pumped continuously from 2 depths (bottom and 2-3' above bottom) through multi-parameter probes (temp, pH, DO, EC) and fluorometers (CDOM, chl-a)



Preliminary Data from 8/07 Boat Recon, Fremont Ford to Crows Landing

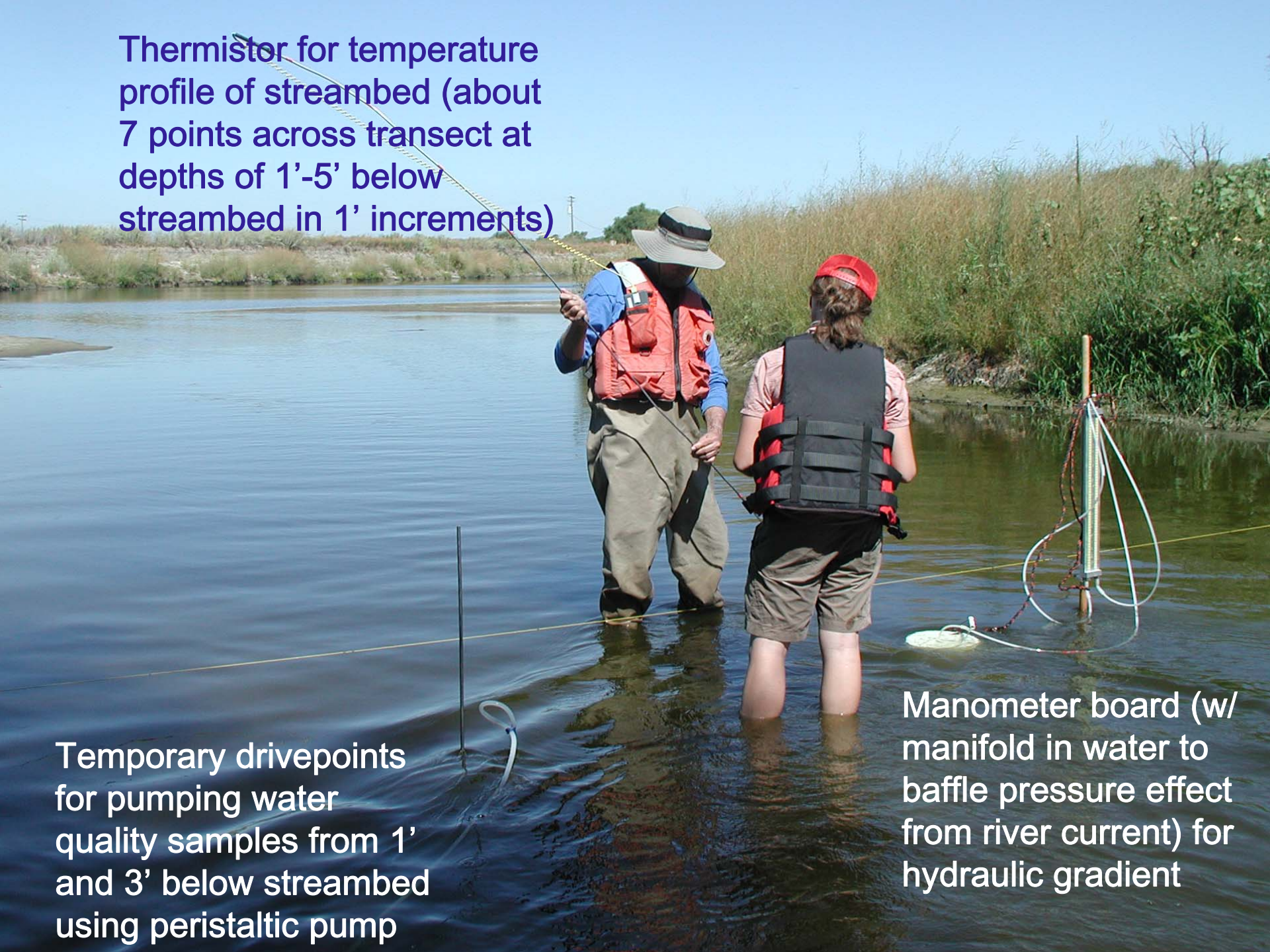


Synoptic Sampling (8/07)

Thermistor for temperature profile of streambed (about 7 points across transect at depths of 1'-5' below streambed in 1' increments)

Temporary drivepoints for pumping water quality samples from 1' and 3' below streambed using peristaltic pump

Manometer board (w/ manifold in water to baffle pressure effect from river current) for hydraulic gradient



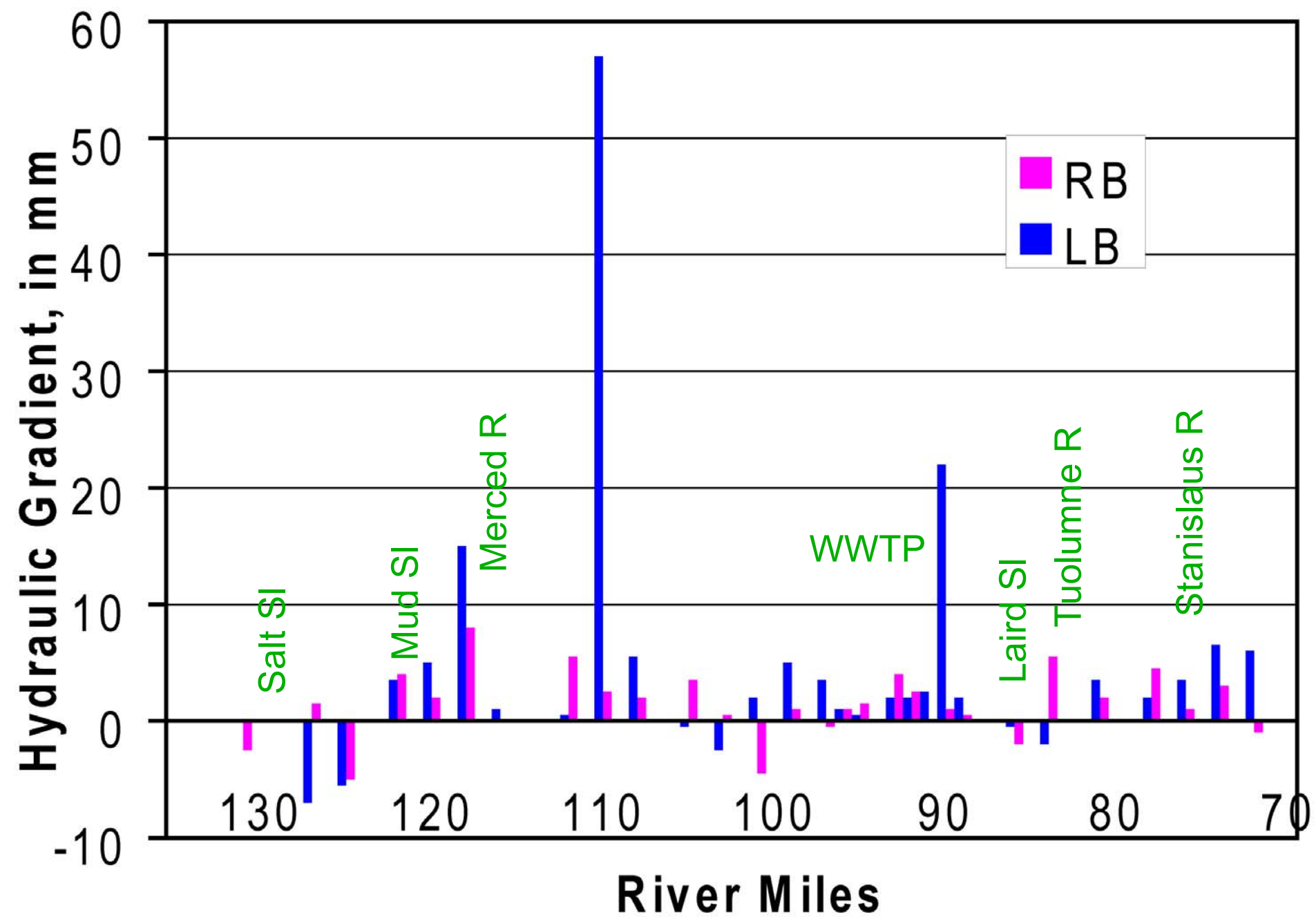
Sampling gear for synoptic:

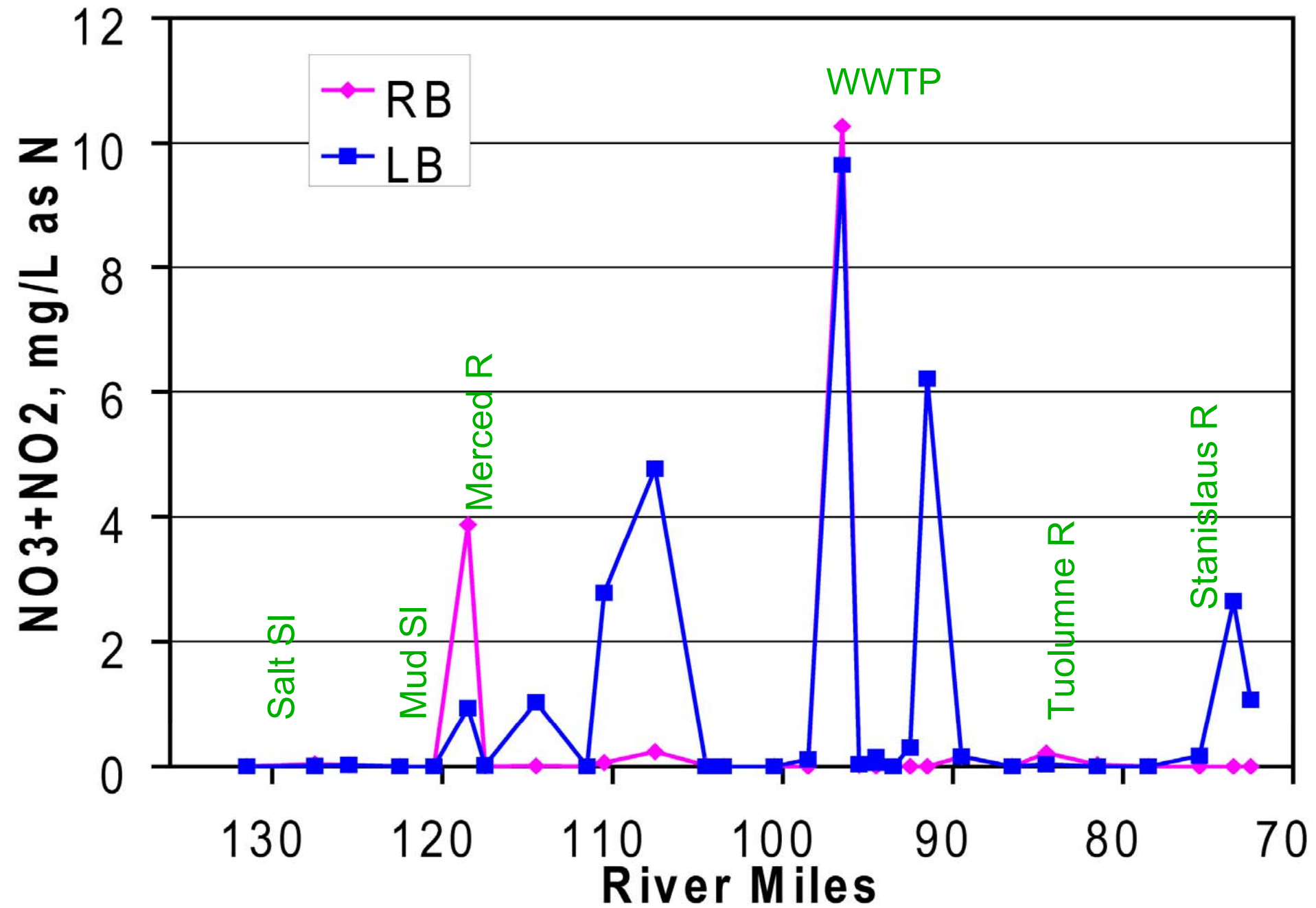
- peristaltic pump
- multiparameter probe
- bottles
- thermistor
- temporary drivepoints
- manometer board
- tagline, etc.

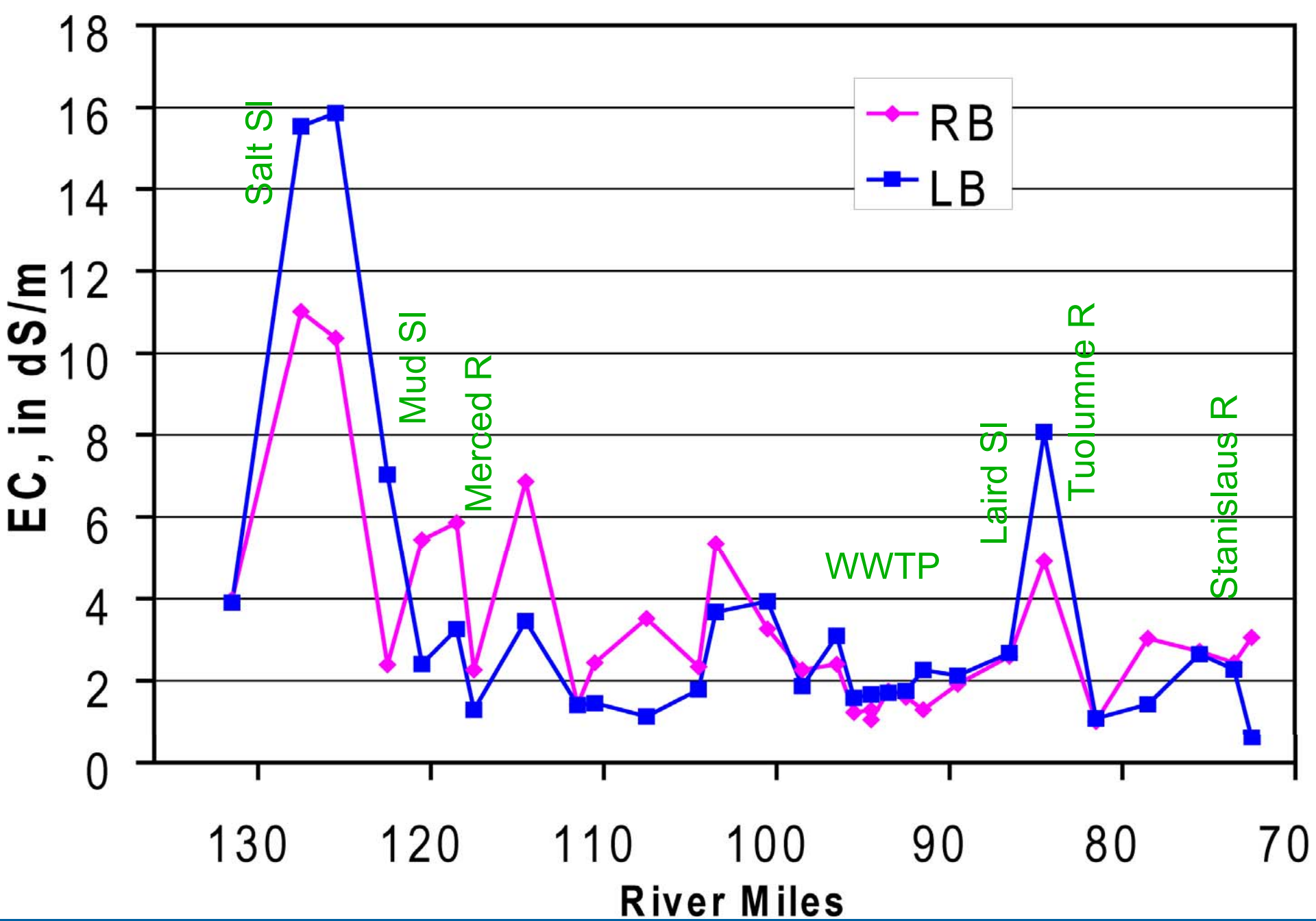


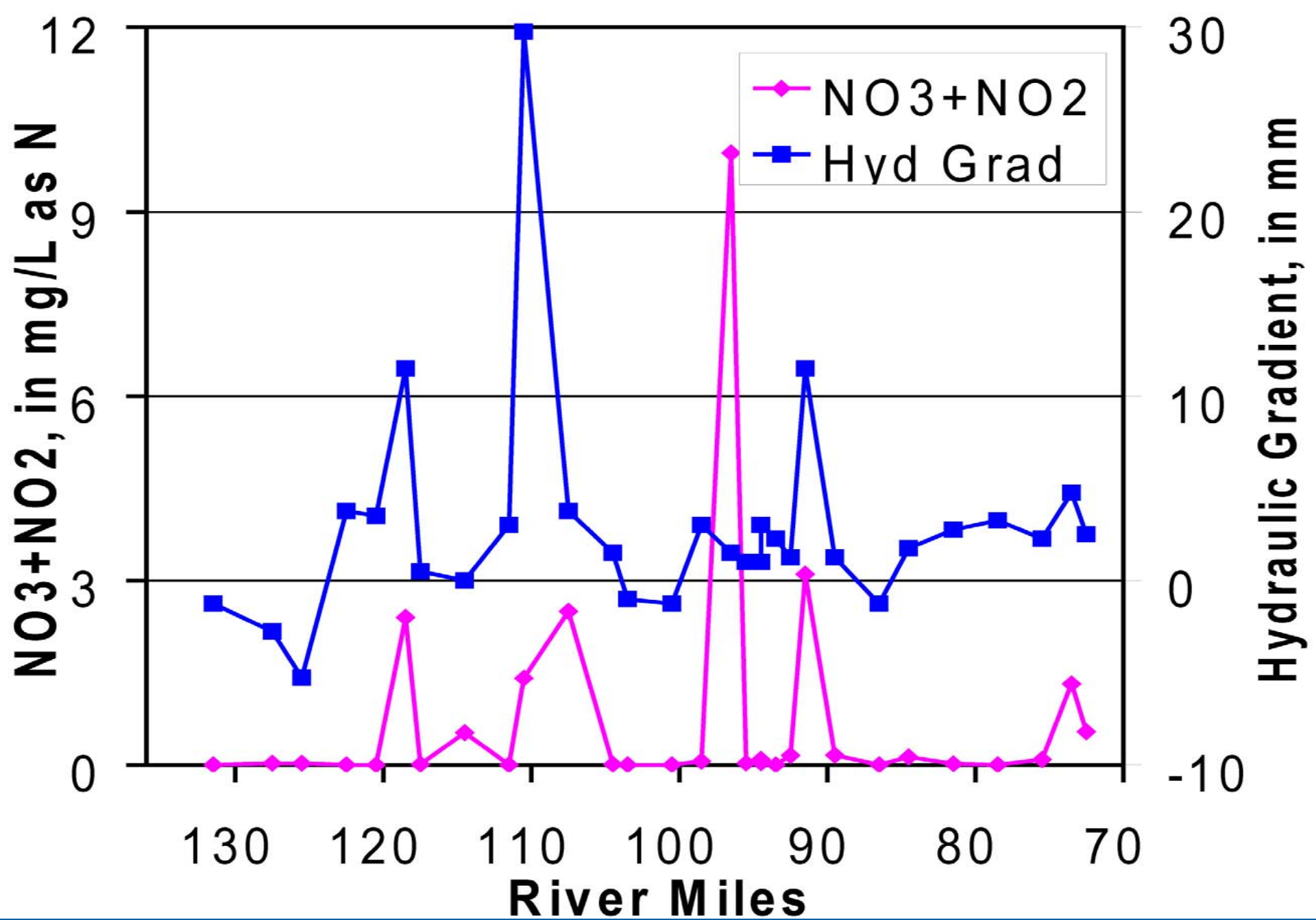
Sampling for
N gas using
evacuated
bottles with
hypodermic
needle

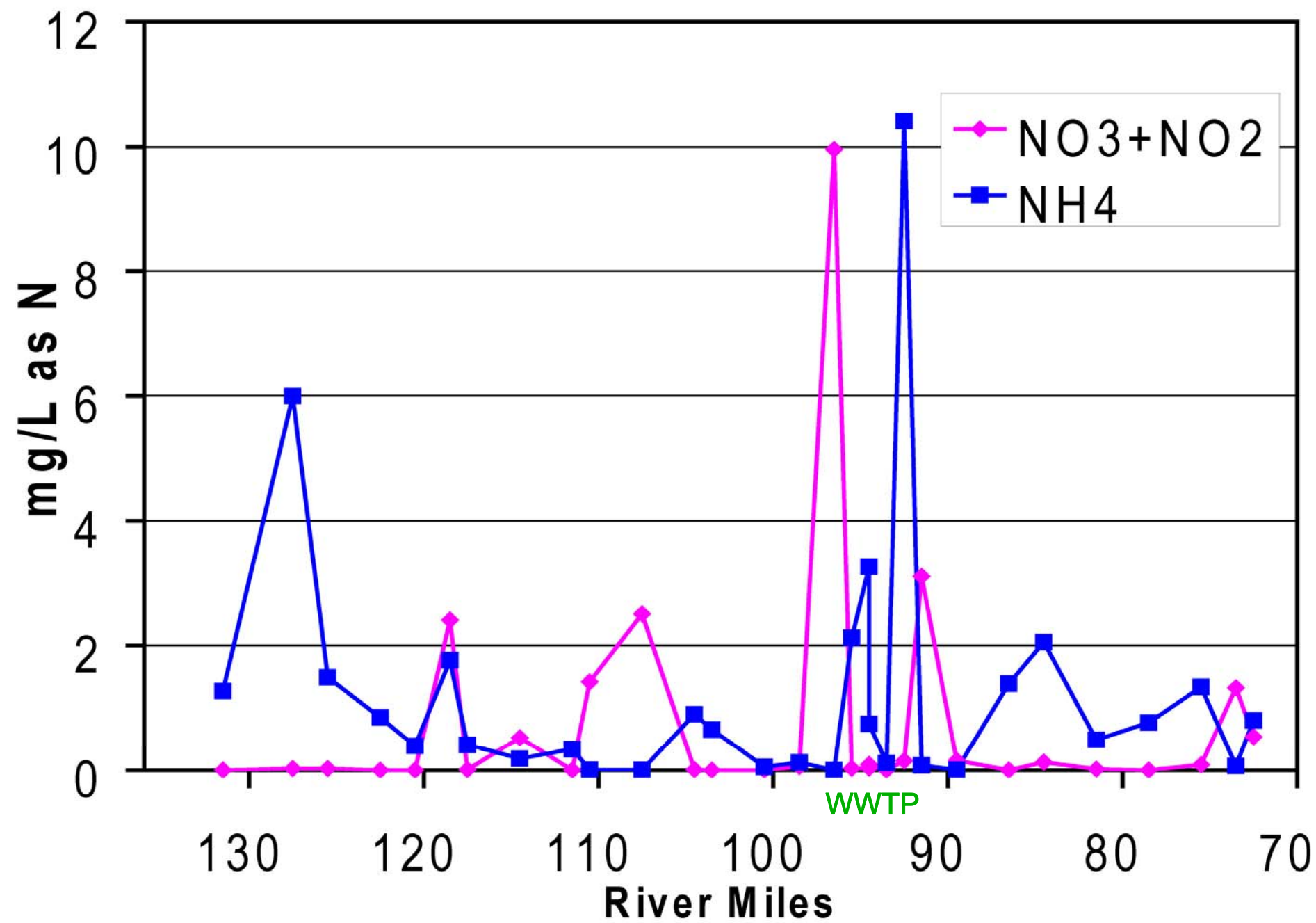












Conclusions

- Water quality in the bank wells is surprisingly similar to 20 years ago
- Some sites have very high DOC in streambed relative to GW (bank wells) and river concentrations
- Nitrate and ammonia are inversely related in the streambed, as expected from redox conditions
- Nitrate appears to be high where the upward gradients are highest
- More data collection and interpretation (especially of GW flow rates) is needed!